The Development of an Inexpensive Hand Hygiene Monitoring System with a Raspberry Pi Computer: Applications for Healthcare and Beyond

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Aim: Preventing hospital-acquired infections is a challenge for healthcare facilities. This study aimed to design and create an accurate, easy to use, and inexpensive system for electronically monitoring/recording hand hygiene (HH) in healthcare as a tool to aid in preventing hospital-acquired infections. Methods: A $35 Raspberry Pi computer controlled/recorded data from infrared sensors and RFID readers on a 1) sink and soap pump (hand washing) and 2) hand sanitizer dispenser. RFID tags were housed in healthcare workers' wristbands: they scanned a wristband and performed normal HH. The system recorded HH details: type, duration, date/time, and wristband ID. Preset parameters removed non-HH events. System parameters and accuracy were tested under randomized laboratory conditions (n=532 tasks), in experimental settings (healthcare workers/nursing students performed instructed HH, n=160 tasks), and while nursing students simulated patient care (n=78 tasks). Computer records were matched with direct observation. Fifty-nine healthcare workers and nursing students evaluated the system's construct validity. Results: Randomized laboratory testing found 100% system detection accuracy. Accuracy with healthcare users was 100% and 95.7% for hand sanitizer and hand washing, respectively (p=0.498). HH accuracy was not significantly affected by introduced nursing tasks. Healthcare persons found the system easy to use (100%) and believed it could improve patient care (90.7%). Estimated reproduction cost is $80. Conclusion: This system accurately monitors HH events, is inexpensive, and is easy to use. It is useable for regular HH monitoring, HH evaluation during intervention research, monitoring during disease outbreaks, identification of poor hand-washers, and HH education.

Awards Won: